

**MID-COURSE REVIEW of the  
RHODE ISLAND ATTAINMENT PLAN for the  
ONE-HOUR OZONE NATIONAL AMBIENT AIR  
QUALITY STANDARD**

**December 2004**

**Rhode Island Department of Environmental Management  
Office of Air Resources**

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## I. Introduction

In March 2003, the Rhode Island Department of Environmental Management (RI DEM) submitted the “Rhode Island Attainment Plan for the One-Hour National Ambient Air Quality Standard” (Attainment Plan) to the United States Environmental Protection Agency (EPA) as a revision to the State’s State Implementation Plan (SIP). The plan demonstrated, using a “weight of evidence” approach, that Rhode Island will attain the one-hour ozone standard by 2007. EPA approved the Attainment Plan at 40 CFR 52.2088.

In the Attainment Plan, Rhode Island agreed to submit to EPA by December 31, 2004 a mid-course review demonstrating that Rhode Island remains on track to attain the one-hour standard by 2007. This commitment remains intact even though EPA will revoke the one-hour standard as of June 15, 2005 and subsequent planning and emissions reduction efforts will focus on achieving the more stringent 8-hour standard. This document will serve as Rhode Island’s mid-course review.

## II. Attainment Plan

The 2003 Attainment Plan presented the following line of reasoning to demonstrate that Rhode Island will achieve the one-hour standard by 2007.

- ◆ NO<sub>x</sub> emissions in upwind states are the major cause of elevated one-hour ozone levels in Rhode Island. Evidence presented in support of this statement include the following:
  - Back trajectory analyses using the HYSPLIT model, which show that air masses on days that elevated one-hour ozone concentrations occurred in Rhode Island in 1999-2002 had passed through the New York City/New Jersey metropolitan area;
  - The results of EPA CALGRID photochemical modeling, which shows that NO<sub>x</sub> reductions in upwind areas would eliminate or substantially reduce the severity and extent of ozone exceedances in Rhode Island, while similar reductions in Rhode Island would have no significant effect on the State’s ozone levels; and
  - Results from EPA CAM-X source apportionment modeling, which shows that emissions in New York and New Jersey together are responsible for an average of 54% of the total anthropogenic ozone in Rhode Island, emissions in Pennsylvania, Ohio, Virginia and West Virginia are responsible for 29% and Rhode Island and Connecticut emissions together contribute only 5% to these levels.
- ◆ Substantial emissions reductions will occur between 2002 and 2007 in upwind states, as well as in Rhode Island. The attainment plan identifies emissions reduction measures that will be implemented by 2007 and presents projected NO<sub>x</sub> inventories for the New York City metropolitan area, New Jersey and Connecticut as well as for Rhode Island that show that substantial reductions in NO<sub>x</sub> emissions (9.5 – 23%) will occur between 2002 and 2007.

- ◆ Expected emissions reductions will bring Rhode Island into attainment by 2007. The evidence for this conclusion included:
  - An analysis of ozone design value trends which shows that the number and severity of ozone exceedances in Rhode Island and downwind areas have decreased when upwind emissions were reduced and that the emissions controls programs that will be implemented by 2007 will further decrease ozone levels;
  - A relative analysis of EPA's photochemical modeling results that applies the percent reductions in ozone concentrations predicted by the model to the base year design values for sites in Rhode Island and downwind areas. That analysis shows attainment at those sites by 2007;
  - Calculations that show that the Tier 2/gasoline sulfur program, which was not considered in the photochemical modeling, will reduce peak ozone levels at Rhode Island sites by an additional 1 ppb; and
  - The observation that the highest 2002 design value in Rhode Island was 130 ppb, which is only 4% higher than the one-hour standard and that the substantial NO<sub>x</sub> emissions reductions expected in upwind areas between 2002 and 2007 will be sufficient to reduce ambient levels by the needed 4%.

### III. 2004 Status

Rhode Island continues to be on track to attain the one-hour ozone standard by 2007, as evidenced by current design values, ambient concentration trends and progress in the implementation of emissions reduction programs. A discussion of those issues follows.

#### Current Design Values

The 2004 design values for Rhode Island monitors and monitors in downwind areas are shown in Table I. The highest 2004 Rhode Island design value is 121 ppb, which is 4 ppb (3%) below the standard of 125 ppb. The 2004 design values for all downwind monitors but one, Kennebunkport, Maine, are also below 125 ppb; the design value for Kennebunkport is 126, only slightly above the standard. Note that all four exceedances that contributed to Kennebunkport's design value occurred in 2002, an unusually hot summer. No exceedances have occurred at that site in the past two years. Therefore, it is probable that the design value for that site for 2005 and beyond will be below the standard. Therefore, all of the sites in Rhode Island already have design values below the one-hour standard and the design values for all of the monitors in the downwind areas are either already in attainment of the standard or will likely be in attainment of the standard in the near future.

### Ambient Concentration Trends

The number of one-hour exceedances that have occurred in each year from 1984 – 2004 at each of the Rhode Island ozone monitoring stations are listed in Table II and shown graphically in Figure I. The number of exceedances in three-year periods are listed in Table III and shown in Figure II. A monitor is in violation of the one-hour standard if it records more than three exceedances in a three- year period. Therefore, if a monitor records an average of one or less ozone exceedance per year, it is not violating the standard.

The current Rhode Island ozone monitoring network consists of sites in West Greenwich, East Providence and Narragansett. The Narragansett site was the last of the sites to begin operation; the first year that data was collected at that site for a complete ozone season was 1997. During five of the seven ozone seasons from 1997 through 2004, one or no exceedances were recorded at the West Greenwich and Narragansett monitors. The East Providence monitor recorded one or no exceedances during six of the seven years. Therefore, the Rhode Island monitors have clearly been close to attaining the standard for several years.

As can be seen in Table III and Figure II, the West Greenwich monitor was in monitored attainment of the one-hour standard in 1998, 1999 and 2000, since there were no more than three exceedances at that site in the three-year periods ending in those years. The East Providence monitor was in monitored attainment from 1996, the first year that a design value was available for that site, through 2000. However, during the hot, dry summer of 2001, both West Greenwich and East Providence recorded three exceedances and, in the even hotter summer of 2002, West Greenwich recorded two and East Providence one additional exceedance. As a result, the total numbers of exceedances at both sites in the three-year periods ending in 2001, 2002 and 2003 were greater than three, and thus the sites were in monitored nonattainment for those years.

Due to coastal meteorology, ozone levels at the Narragansett site sometimes differ significantly from those at the other Rhode Island sites. The Narragansett monitor recorded two exceedances in 1999 and 2001 and one or no exceedances in the other years of its operation. The Narragansett monitor has violated the one-hour standard for only one year, 2001; five exceedances were recorded at that site in the 1999 – 2001 ozone seasons.

One or no exceedances have been recorded at East Providence or Narragansett in each year since 2001 and at West Greenwich in each year since 2002. Therefore, ambient trends are consistent with Rhode Island being on track to be in attainment in 2007.

### Implementation of Emissions Reductions Programs

As discussed above, the Attainment Plan presented evidence, including photochemical modeling, source apportionment modeling and back trajectory modeling, that showed that emissions from upwind states, particularly the New York City/New Jersey metropolitan area, are primarily responsible for elevated ozone levels in Rhode Island. No further photochemical or source apportionment modeling for the one-hour standard has been performed since the Attainment Plan has been submitted. However, RI DEM has produced back trajectories for the two days that

ozone exceedances occurred in the State since 2002 using the HYSPLIT model. Those days are June 27, 2003, when a one-hour peak of 129 ppb was recorded at Narragansett and June 9, 2004, when the one-hour peak level was 136 ppb at Narragansett and 131 ppb at the West Greenwich site.

The back trajectories for the 2003 and 2004 exceedances days are attached as Figures III – V. As was the case for the ozone episodes analyzed in the Attainment Plan, the near-surface air masses on those days, which are associated with short-term transport, passed through the New York City/New Jersey metropolitan area, while the higher air masses, associated with longer-range transport, originated in or passed through New York State, Ohio and Pennsylvania. This demonstrates that emissions in upwind areas continue to be important contributors to ozone levels in Rhode Island.

The emissions projections in the Attainment Plan were predicated on the assumption that several national, regional and state emissions control measures and programs would be implemented by 2007, resulting in emission reductions in Rhode Island and upwind states. Implementation of those measures is proceeding on schedule. Specifically:

- ◆ EPA's NO<sub>x</sub> budget program has been implemented in the eastern United States;
- ◆ Phase-in of EPA's Tier 2 tailpipe standards for motor vehicles is proceeding on schedule. The sulfur content of fuels was reduced in 2004 and will be further reduced in 2006.
- ◆ EPA's NO<sub>x</sub> requirements for highway heavy-duty engines, which require a 50% reduction in emissions from new diesel trucks and buses from baseline levels, have been instituted for new engines beginning in 2004.
- ◆ Non-road diesel NO<sub>x</sub> standards, which were first implemented in 1996 and have become increasingly more stringent in subsequent years, are being phased in through 2006; and
- ◆ A number of upwind states have adopted or will adopt new VOC limitations for architectural coatings and consumer products and specifications for portable fuel containers that will be effective in 2004 or 2005. Rhode Island plans to adopt those standards in 2005. The status of the adoption of those regulations in the states in the Ozone Transport Region (OTR) is shown in Table IV.

In conclusion, the fact that Rhode Island is currently in monitored attainment, along with an analysis of trends in ambient ozone levels and the fact that emissions reductions programs are proceeding on schedule demonstrate that the State is on track to be in attainment of the one-hour ozone standard by 2007.

**Table I 2004 Design Values in Rhode Island and Downwind Areas (ppb)**

<b>STATE/ SITE ID</b>	<b>SITE NAME</b>	<b>2004 DESIGN VALUE</b>
<b>Rhode Island</b>		
44-003-0002	West Greenwich	121
44-007-1010	East Providence	115
44-009-0007	Narragansett	120
<b>Southern Maine</b>		
23-005-2003	Cape Elizabeth	121
23-011-2005	Gardiner	102
23-013-0004	Knox Co.	109
23-017-3001	Oxford Co.	78
23-031-2002	Kennebunkport	126
23-031-3002	Kittery	117
<b>Eastern Massachusetts</b>		
25-001-0002	Truro	118
25-005-1002	Fairhaven	113
25-009-2006	Lynn	118
25-009-4004	Newbury	118
25-017-1102	Stow	112
25-025-0041	Boston – Long Island	124
25-025-0042	Boston - Harrison	97
25-027-0015	Worcester	109
<b>Southern New Hampshire</b>		
33-001-2004	Laconia	93
33-011-0020	Manchester	105
33-013-0007	Concord	95

**Table II Number of Exceedances of One-Hour Ozone Standard at Rhode Island Sites**

	<b>W. Greenwich</b>	<b>Providence</b>	<b>E. Providence</b>	<b>Narragansett</b>
1984	15	5		
1985	7	3		
1986	3	3		
1987	7	2		
1988	7	4		
1989	2	0		
1990	6	0		
1991	9	0		
1992	1	0		
1993	1	0		
1994	1	1	1	
1995	3	1	2	
1996	0	0	0	
1997	1	0	0	
1998	0		0	0
1999	1		0	2
2000	0		1	1
2001	3		3	2
2002	2		1	0
2003	0		0	1
2004	1		0	1

**Table III Number of Exceedances of One-Hour Ozone Standard in 3-Year Periods\***

	<b>W. Greenwich</b>	<b>Providence</b>	<b>E. Providence</b>	<b>Narragansett</b>
1984 - 86	25	11		
1985 - 87	17	8		
1986 - 88	17	9		
1987 - 89	16	6		
1988 - 90	15	4		
1989 - 91	17	0		
1990 - 92	16	0		
1991 - 93	11	0		
1992 - 94	3	1		
1993 - 95	5	2		
1994 - 96	4	2	3	
1995 - 97	4	1	2	
1996 - 98	1		0	
1997 - 99	2		0	
1998 - 2000	1		1	3
1999 - 2001	4		4	5
2000 - 02	5		5	3
2001 - 03	5		4	3
2002 - 04	3		1	2

\*The one-hour ozone standard allows 3 exceedances in a three-year period.



**Table IV Status of Adoption of Additional Control Regulations in OTR States**

	<b>Consumer Products</b>	<b>Architectural and Industrial Maintenance Coatings</b>	<b>Portable Fuel Containers</b>
Connecticut	Will consider	Will consider	Adopted 5/10/04
Delaware	Adopted; Effective 1/11/02	Adopted; Effective 3/11/02	Adopted; Effective 1/11/01
DC	Final 4/16/04	Final 4/16/04	Final 4/16/04
Maine	Adopted; Effective 5/1/05	Adopted; Effective 1/1/06	Adopted; Effective 1/1/04
Maryland	Adopted; Effective 11/24/03	Adopted; Effective 2/28/05	Adopted; Effective 1/21/02
Massachusetts	Intend to develop	Intend to develop	Intend to develop
New Hampshire	In progress	In progress	Adopted; Effective 3/1/06
New Jersey	Adopted; Effective 6/6/04	Adopted; Effective 6/21/04	Adopted; Effective 6/6/04
New York	Published 10/30/02; Effective 11/09/02	Published 11/12/03; Effective 11/23/03	Published 10/23/02; Effective 11/04/02
Pennsylvania	Published 10/05/02; Effective 10/5/02	Published 10/25/03; Effective 10/25/03	Published 10/05/02; Effective 10/5/02
Rhode Island	In progress	Intend to develop	Intend to develop
Vermont	Will consider	Considered in RACT determination*	Will consider
Virginia	Adopted; Effective 3/9/05	Adopted; Effective 3/24/04	Adopted; Effective 3/24/04

Figure I Exceedances of the One-Hour Ozone Standard

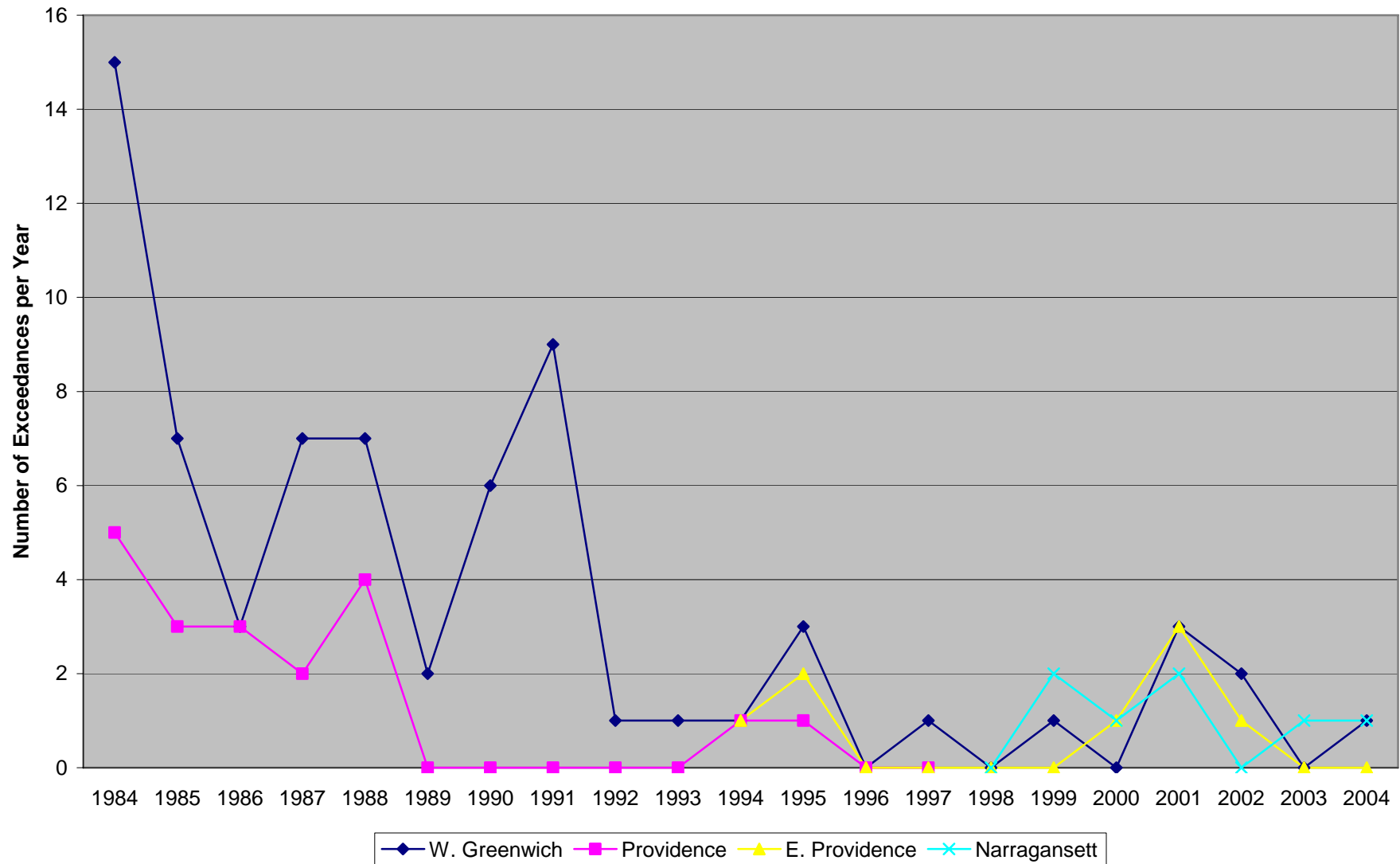
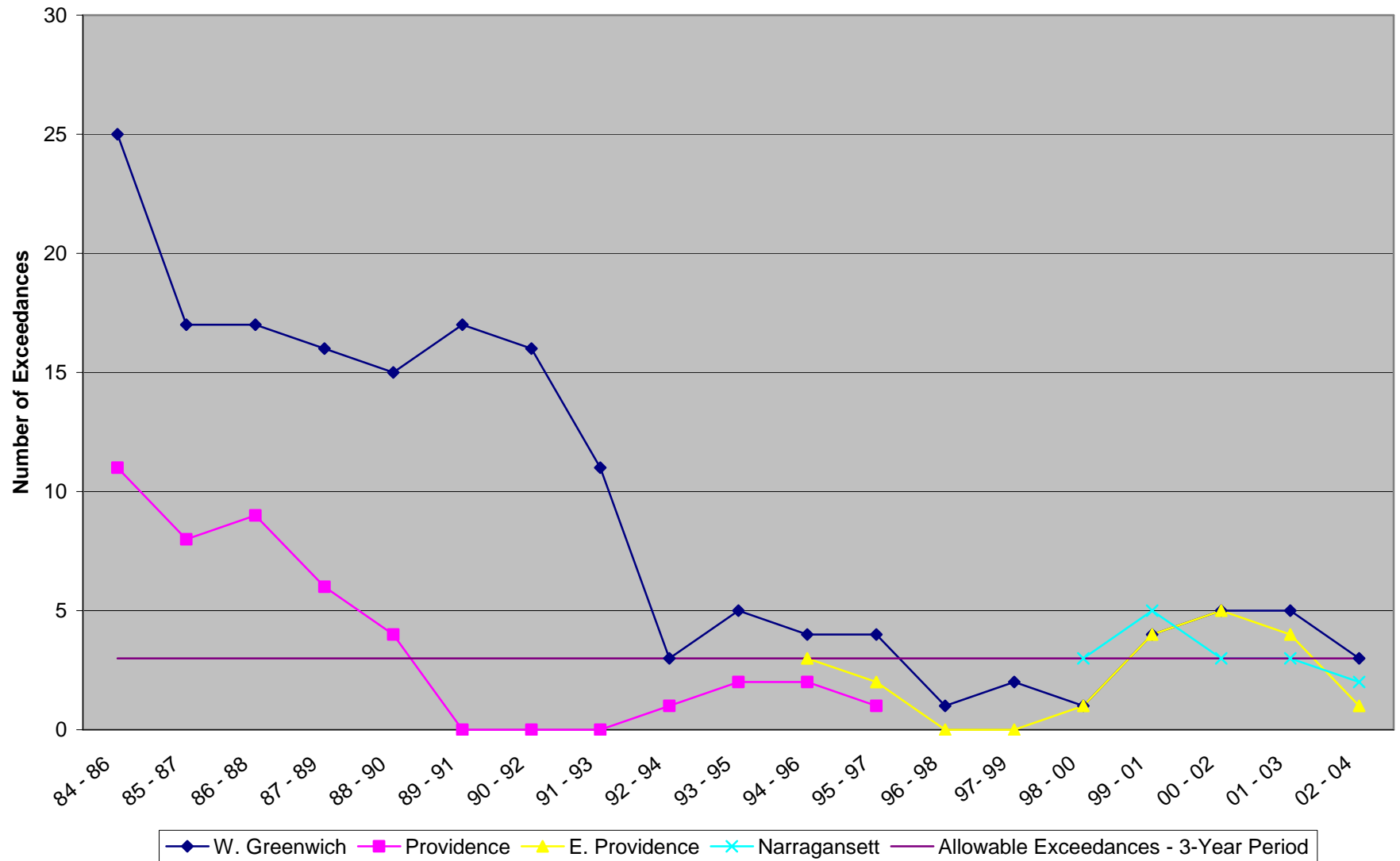
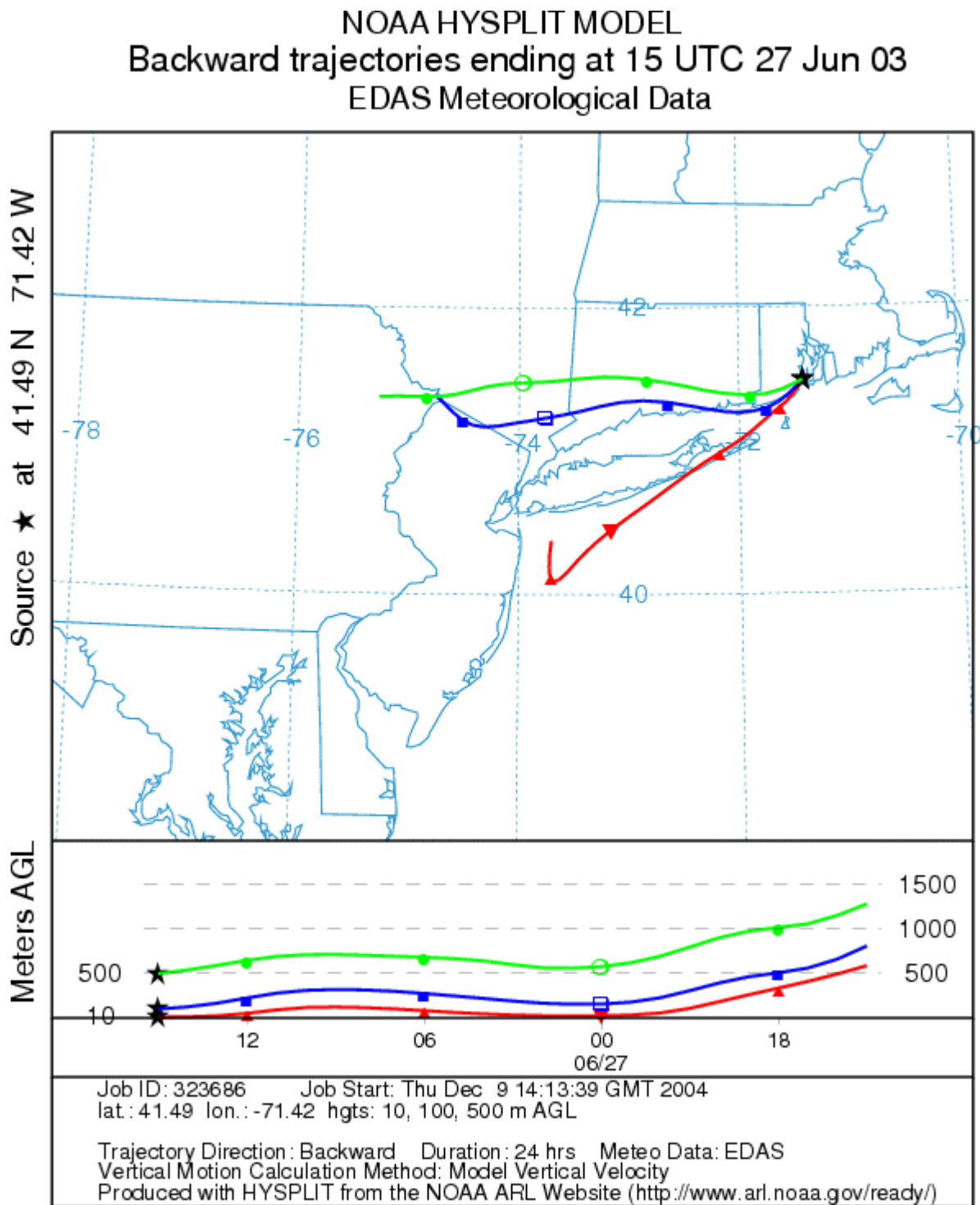


Figure II Number of Exceedances in 3-Year Period

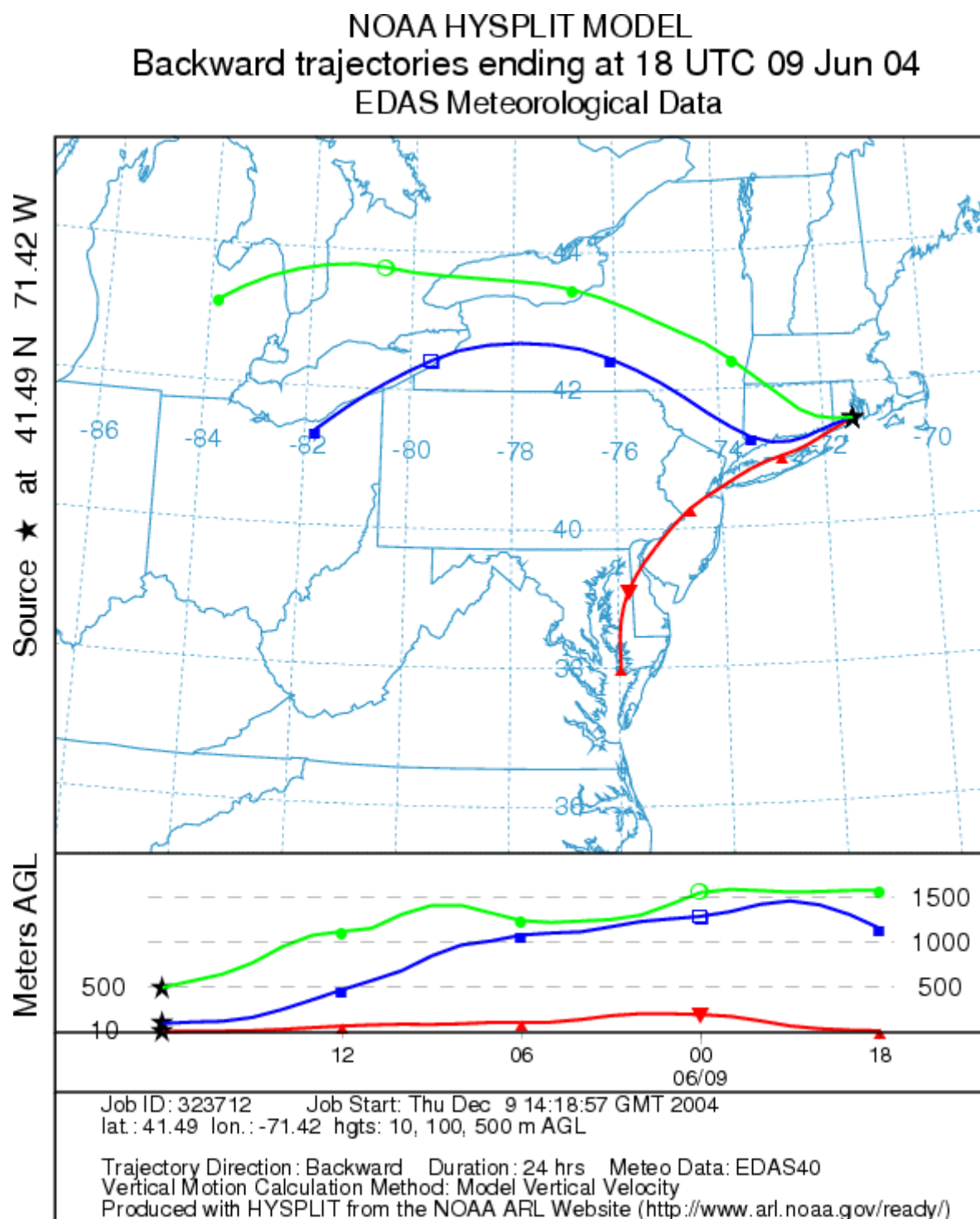




**Figure III Back Trajectory Model for Narragansett Site for June 27, 2003**  
**Ozone Concentration at Narragansett was 129 ppb**



**Figure IV Back Trajectory Model for Narragansett Site for June 9, 2004**  
**Ozone Concentration at Narragansett was 136 ppb**



**Figure V Back Trajectory Model for West Greenwich Site for June 9, 2004**  
**Ozone Concentration at West Greenwich was 131 ppb**

